INTRODUCTION

The U.S. Army Corps of Engineers, San Francisco District (Corps), and the City of St. Helena, California, the project's non-Federal sponsor, propose to remove or modify Upper York Creek Dam and appurtenances, remove accumulated sediment, and restore the local ecosystem structure. Removing or modifying the dam would improve fish passage for the federally listed steelhead *(Oncorhynchus mykiss*), would reduce the potential for future downstream sediment releases and fish kills, and would allow for the restoration of approximately 3 total acres of degraded riparian and riverine habitat surrounding Upper York Creek Dam.

This report presents the findings of the alternatives analysis and the selection of a recommended plan for the Upper York Creek Ecosystem Restoration Project.

EXISTING CONDITIONS

The Upper York Creek Ecosystem Restoration Project is located within the five-square mile York Creek drainage basin, to the northwest of the City of St. Helena, Napa County, approximately 60 miles north of San Francisco. York Creek is a tributary to the Napa River, which flows to the Pacific Ocean via San Pablo Bay. The creek flows in an easterly direction through a narrow canyon before joining the Napa River northeast of the city of St. Helena in Napa County at an elevation of approximately 225 ft.

The project site includes the Upper St. Helena Dam (Upper York Creek Dam), Upper York Creek Reservoir (Upper Reservoir), and the Lower York Creek Reservoir (Lower Reservoir) on York Creek (See Figure 1). The Upper York Creek Dam is a 50-foot high, 140-foot long earthen dam that was completed in 1900 and is located approximately 1.5 miles upstream of the City of St. Helena. The Upper Reservoir, though now abandoned as the result of siltation, was originally used for water storage. The Upper York Creek Dam and Upper Reservoir, combined, cover approximately 3 acres. Lower York Creek Reservoir is located about one mile down Spring Mountain Road from the Upper Reservoir that is currently utilized as an untreated water supply to meet a portion of the City’s irrigation and construction water demands.

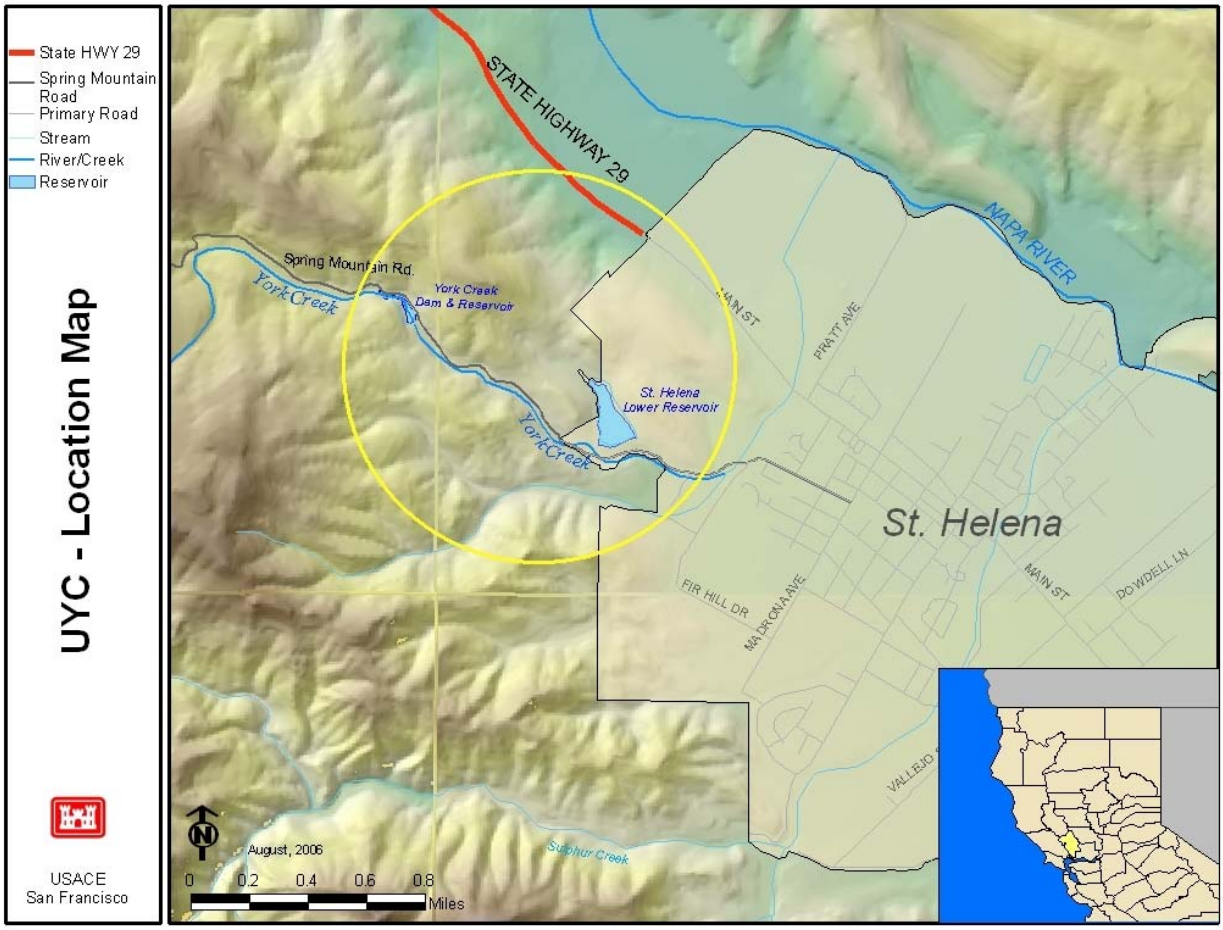

Figure 1: Project Location

A 2005 Salmonid Habitat Report by the Napa County Resource Conservation District (NCRCD) found that overall, York Creek is one of the most significant spawning and rearing streams for steelhead within the Napa Basin. Specifically, the upper reaches of York Creek offer excellent rearing and spawning habitat, and creating access to these areas would greatly benefit the overall steelhead population. York Creek has also been designated as critical habitat for threatened Central California Coast steelhead by the National Marine Fisheries Service (NMFS, 2000). Surveys by the National Marine Fisheries Service (NMFS) and the California Department of Fish and Game (DFG) have indicated that steelhead are abundant in York Creek below the York Creek Dam. Additionally, electrofishing efforts by Stillwater Sciences in 2005 determined that rainbow trout[1] are also present above the Upper York Creek Dam and Reservoir.

[1] **Rainbow trout**: Rainbow trout and steelhead are the same species of fish; the two names reflect two distinct life history patterns. The name rainbow trout is used for the non-anadromous life history. Rainbow trout do not leave the stream to go to the ocean. They spend their entire life in the stream. Anadromous forms of the trout can convert to resident populations when drought events or damming of rivers blocks their access to the ocean. Conversely, resident trout populations can become anadromous if ocean access becomes available (NCRCD, 2006). There is a rainbow trout population above Upper York Creek Dam.

Upper York Creek Dam has been identified as a significant obstacle to passage for steelhead in the threatened Central California Coast (CCC) Evolutionary Significant Unit. The removal or breeching of Upper York Creek Dam would open approximately 2 miles of suitable upstream habitat for steelhead.

PROJECT OBJECTIVES

The planning objectives are specified as follows:

- **OBJECTIVE: Improve fish passage.** To restore an aquatic corridor for all life stages of the federally listed steelhead *(Oncorhynchus mykiss)* and other aquatic based wildlife in the York Creek watershed and to reconnect and restore spawning, rearing, and migratory habitat for the steelhead and other aquatic wildlife from beneath the dam to approximately 2 miles upstream.

- **OBJECTIVE: Reduce future downstream habitat degradation and fish kills.** To reduce the risk of uncontrolled sediment releases that have been shown to cause fish and aquatic organism kills downstream of the dam and to restore a natural sediment transport system (fluvial process) through the project area.

- **OBJECTIVE: Habitat Restoration.** To restore approximately 3 total acres of degraded riparian and riverine habitat at and above Upper York Creek Dam.

- **OBJECTIVE: Connectivity.** To provide aquatic habitat connectivity for fish and aquatic wildlife species populations through the project site.

ALTERNATIVE PLANS

A preliminary and then a final array of alternatives were formulated to address identified problems and opportunities. Alternatives include measures to address fish passage, downstream sediment releases, habitat restoration, and aquatic habitat connectivity. The final alternatives are shown below in Table 1.

Table 1: Final Alternatives

Final Alternative	Description of Alternative
No-Action	No ecosystem restoration measures would be implemented.
Alternative 1: Complete Removal	Complete removal of dam and the right wall of the spillway. Complete removal of sediment. Restoration of natural channel and restoration of riverine and riparian habitat.
Alternative 2B: Small Notch	Notch Dam: Minimize notch size to the minimum hydrologic passage of 23 feet due to slope stability constraints. 72% removal of dam and 95% removal of sediment. Restoration of natural channel and restoration of riverine and riparian habitat.
Alternative 3: Fish Ladder	Modify (notch/lower) dam to existing streambed level above dam and construct fish ladder to this height. 37% removal of sediment. Restoration of natural channel and restoration of riverine and riparian habitat.

All alternatives include various levels of accumulated sediment removal, dam material removal, and revegetation. The revegetation plan for all alternatives would be similar as all alternatives would require revegetation of approximately 2 acres of disturbed area. Table 2 lists the basic differences between the project alternatives including the differences in total width of the excavated channel, as well as the amount of dam and sediment material removed for each alternatives.

Table 2: Details of Project Alternatives.

Alternative	Width of Total Excavated Channel (ft)	Constructed Stream Width (ft)	Constructed Bench Width (ft)	Dam Material			Reservoir Material	
				Dam Material Removed (Cubic yards)	Percentage of Dam Removed	Removal of Spillway	Reservoir Material Removed (Cubic Yards)	Percentage of Accumulated Reservoir Material Removed
No Action	NA	NA	NA	NA	NA	NA	NA	NA
1	53	23	30	16,284	100%	Right Wall Removed	28,100	100%
2B	23	23	0	11,777	72%	No	26,637	95%
3	23	23	0	8,431	52%	No	10,372	37%

Below, Figure 2 is conceptual cross sections of each alternative as they would appear through the dam.

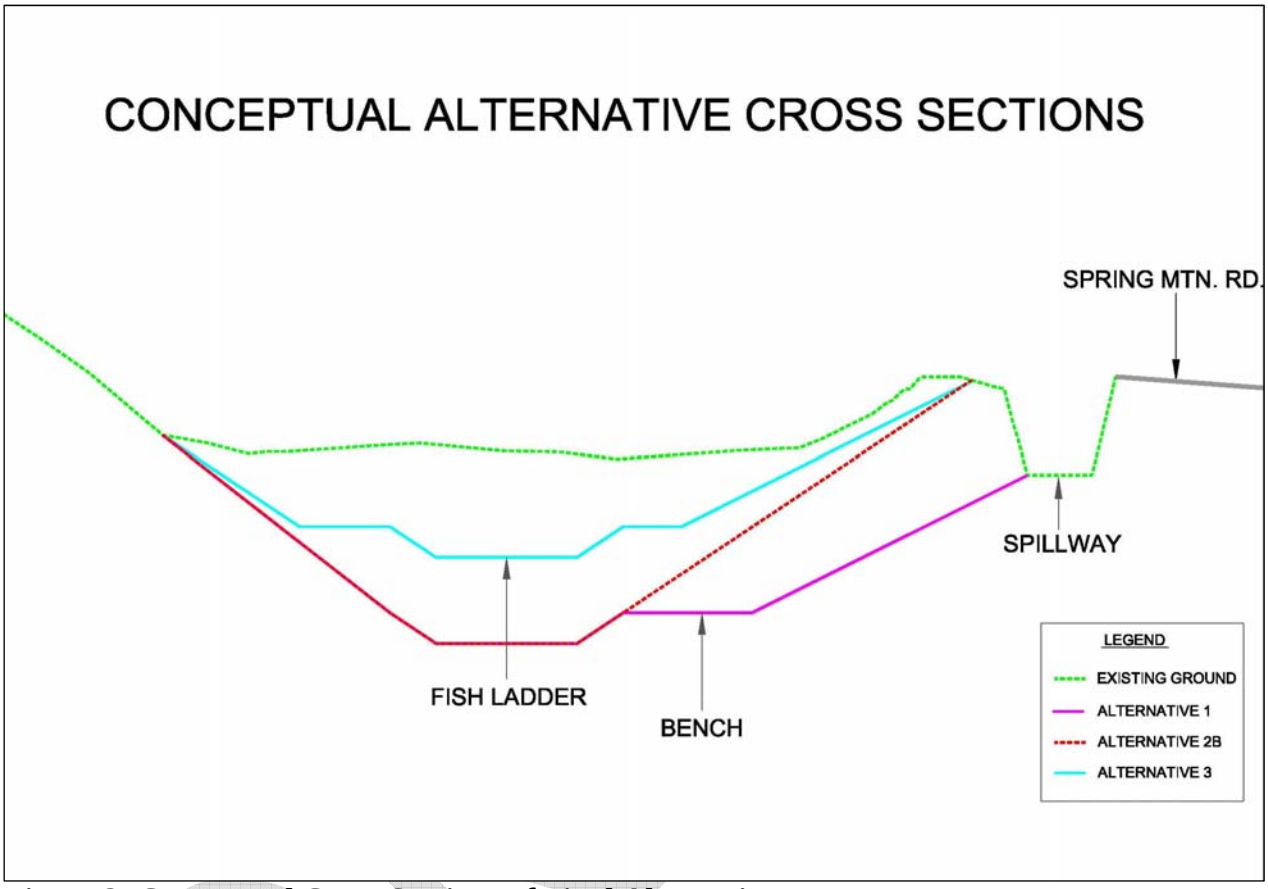

Figure 2: Conceptual Cross Sections of Final Alternatives

NO ACTION ALTERNATIVE

The No Action Alternative assumes that no ecosystem restoration measures are implemented. There would be no action taken to modify Upper York Creek Dam from its current configuration, there would be no removal of trapped sediments from behind the dam, and no fish passage would be restored to the upper reaches of York Creek.

ALTERNATIVE 1: COMPLETE REMOVAL OF DAM AND RIGHT WALL OF SPILLWAY

Alternative 1 is designed to be the most complete removal of the dam. The entire earthen dam would be removed and looking upstream, the right wall of the spillway would be removed. This would provide for a total channel width of 53 feet. Because the determined width for the restored creek is 23 feet, this alternative could have up to a 30 foot bench.

In general, Alternative 1 includes the following: removal of the entire earthen dam; (2) removal of all of the accumulated sediment from behind the dam; (3) construction and restoration of York Creek from just below the dam to just above the sediment basin with a slope of approximately 5%; (4) revegetation of roughly 2 of aquatic and riparian habitat with native vegetation and; (5) use of native plants for erosion control and site stabilization.

ALTERNATIVE 2B: SMALL NOTCH

Conceptually, Alternative 2B was designed to remove the least amount of the dam and accumulated sediment while providing aquatic passage for the 1% storm event in order to maximize slope stability with the least amount of geotechnical stability measures. Alternative 2B would provide for a total channel width of 23 feet. Because the determined width for the restored creek is 23 feet, this alternative does not allow for a floodplain bench.

In general, Alternative 2B includes the following: (1) removal of approximately TBD% of the earthen dam structure; (2) backfilling the spillway with dam material for stabilization; (3) removal of approximately 95% of the accumulated sediment from behind the dam; (4) construction and restoration of York Creek from just below the dam to just above the sediment basin with a slope of approximately 5%; (5) restoration of roughly 3 total acres of aquatic and riparian habitat with native vegetation and; (6) use of native plants for erosion control and site stabilization.

Alternative 2B is the geotechnically favored alternative as this alternative appears to be the most stable of all alternatives.

ALTERNATIVE 3: FISH LADDER

Alternative 3 is designed to notch the dam as necessary to construct a concrete fish ladder through the notch and over the dam. The suggested fish ladder is a step-pool/weir design through the existing dam site.

In general, Alternative 3 includes the following: (1) notching the dam as necessary to construct a concrete fish ladder through the notch and over the dam; (2) removal of approximately 52% of the earthen dam structure; (3) backfilling the spillway with dam material for stabilization; (4) removal of approximately 37% of the accumulated sediment from behind the dam; (5) construction and restoration of York Creek from above the dam and fish latter upstream through the lowered sediment basin; (6) restoration of roughly 3 total acres of aquatic and riparian habitat with native vegetation and; (7) use of native plants for erosion control and site stabilization.

EVALUATION AND COMPARISON OF ALTERNATIVE PLANS

All of the action alternatives involve varying levels of dam modification, removal of dam material, removal of accumulated sediment material, revegetation of approximately 2 acres, and channel restoration. The final alternatives are differentiated by the portion of dam removed

where Alternative 1 provides the greatest portion of dam removal, Alternative 2B provides for the removal of a "notch" through the dam, and Alternative 3 provides for the lowering of the dam and placement of a fish ladder over the remainder of the dam.

FISH PASSAGE:

Reestablishment of fish passage upstream of Upper York Creek Dam is also common to all the action alternatives, where Alternatives 1 and 2B provide for a restored natural creek bed and Alternative 3 provides for a fish ladder aquatic passage over the lowered dam. For comparison purposes, it is estimated that alternatives 1 and 2B would provide 100% effectiveness for upstream migrating steelhead whereas Alternative 3 would provide for 65-95% effectiveness.

FUTURE DOWNSTREAM HABITAT DEGRADATION AND FISH KILLS:

From the perspective of accumulated sediment and the future threat of sediment release, all action alternatives provide for sediment removal. Alternatives 1 and 2B provide for the removal of 95-100% of sediment and Alternative 3 provides for the removal of 37% of the sediment. The naturally restored creek for alternatives 1 and 2B also provide for the most natural sediment transport system in the future and thus eliminate the threat of an accidental accumulated sediment release. Alternative 3 reduces the threat of accidental sediment releases but does not eliminate it. Alternative 3 would leave 63% of the total accumulated sediment behind the lowered dam.

HABITAT RESTORATION:

All alternatives include the revegetation of roughly 2 acres of disturbed area. Revegetation would focus on creation of self-sustaining native vegetative habitat, control of erosion, and the stabilization of the newly created stream channel.

Riverine restoration in York Creek is most natural for Alternatives 1 and 2B. The primary difference between the action alternatives is that Alternatives 1 and 2B would be constructed, as feasible, to flow through the historical channel. Alternative 3 would be constructed from the top of the fish ladder (over the dam) and through the remaining sediment basin. For Alternative 3, the channel would be 10-12 feet above the original channel bed.

SLOPE STABILITY

Maintaining the stability of the adjoining Spring Mountain Road is considered as a project constraint that must be addressed adequately to achieve project success. To the extent possible in feasibility studies, slope stability concerns have been incorporated into the design of the recommended alternative and the Corps' PDT works closely with the City's geotechnical engineer to ensure that both parties are satisfied with the design and monitoring plans.

Feasibility level geotechnical analysis has determined that Alternative 2B is the preferred alternative for providing fish passage while maintaining a stable project site and protecting the Spring Mountain Road's stability. Alternative 1 requires the highest level of reinforcement measures for the long term structural stability. Alternative 3 is not expected to alter the level of stability from the No Action alternative.

SELECTION OF RECOMMENDED PLAN

The benefits associated with the alternatives have been calculated by combining current steelhead habitat availability with current trout population estimates. Together, this information allows for the calculation of the steelhead carrying capacity for Upper York Creek upstream of the dam. Table 3 summarizes the upstream ecosystem restoration benefits for the project alternatives.

Table 3: Ecosystem Restoration Benefits

Alternative	Upstream Ecosystem Benefit Units		
	Potential Steelhead Carrying Capacity	Percentage Effectiveness for Steelhead Passage	Total Ecosystem Benefits
No Action	1800	0%	0
1	1800	100%	1800
2B	1800	100%	1800
3	1800	65-95%	1205-1710

Below, Table 4 summarizes the benefits and costs for this project.

Table 4: Benefits and Costs (FY 2006 Price Levels)

Cost Items	Alt 1	Alt 2B	Alt 3
Benefits			
Ecosystem Benefits	1810	1810	1205-1710
LERRDs			
Land Acquisition	$167,000	$167,000	$167,000
Federal Administration costs	$93,500	$93,500	$93,500
LERRDs Subtotal	**$260,500**	**$260,500**	**$260,500**
Plans and Implementation Phase			
Geotech	$80,000	$80,000	$80,000
Water Resources	$100,000	$100,000	$100,000
Environmental Compliance	$50,000	$50,000	$50,000
Other	$20,000	$20,000	$20,000
P&I Phase Subtotal	**$250,000**	**$250,000**	**$250,000**
Construction Phase			
Construction	$5,686,238	$4,884,599	$4,055,384
Engineering During Construction	$150,000	$150,000	$150,000
Supervision & Administration	$350,000	$350,000	$350,000
Cultural Resources	$30,000	$30,000	$30,000
Construction Phase Subtotal (inc. LERRDs and P&I)	*$6,726,738*	*$5,925,099*	*$5,095,884*
Monitoring & Adaptive Management	$233,295	$208,266	$211,120
TOTAL FIRST COST	$6,960,033	$6,133,365	$5,307,004
Total Costs			
TOTAL FIRST COST	$6,960,033	$6,133,365	$5,307,004
Interest during construction	$447,788	$384,659	$319,959
TOTAL GROSS INVESTMENT	$7,407,821	$6,518,024	$5,626,963
Total Cost of Maintenance (OMRR&R)	$1,037,258	$1,037,258	$1,936,210
TOTAL COST	$8,445,079	$7,555,282	$7,563,173
Annual Costs			
Annual Costs of Total Gross Investment	$484,891	$435,205	$435,612
Annual Cost of Maintenance (OMRR&R)	$20,745	$20,745	$38,724
Total Annual Costs (AAC)	$505,636	$455,950	$474,336
Average Annual Cost per Ecosystem Benefit	**$268**	**$240**	**$265-$362**

NER PLAN

Alternative 2B is the National Ecosystem Restoration Plan as it is the most cost effective plan for the highest level of ecosystem restoration benefits. The Sponsor is supportive of the NER plan.

RECOMMENDED PLAN

Alternative 2B has been chosen as the recommended plan. The total first project cost is $6,133,365. The Recommended Plan is considered justified based on the significance of the non-monetary benefits as compared to average annual costs. The average annual cost per habitat unit is $240. The total acres of habitat created from this alternative is the sum (3.04 acres) of the restored riparian habitat (2 acres) plus the total acres of spawning habitat made available to steelhead (1.04 acres). The first cost per acre is $2,017,554.